

Arizona

Horticultural Commission

FOURTH ANNUAL REPORT

For the Year Ending June 26, 1912

Phoenix, Arizona, October 1, 1912

LETTER OF TRANSMITTAL

To His Excellency, George W. P. Hunt, Governor of Arizona;

SIR: In accordance with a provision of the Arizona Horticultural Commission Law, we submit herewith the Fourth Annual Report of the Arizona Horticultural Commission, for the year ending June 26, 1912.

Very respectfully,

ANDREW KIMBALL, Thatcher,

Chairman.

W. K. BOWEN, Mesa,

Member.

R. H. FORBES, Tucson,

Secretary-Treasurer.

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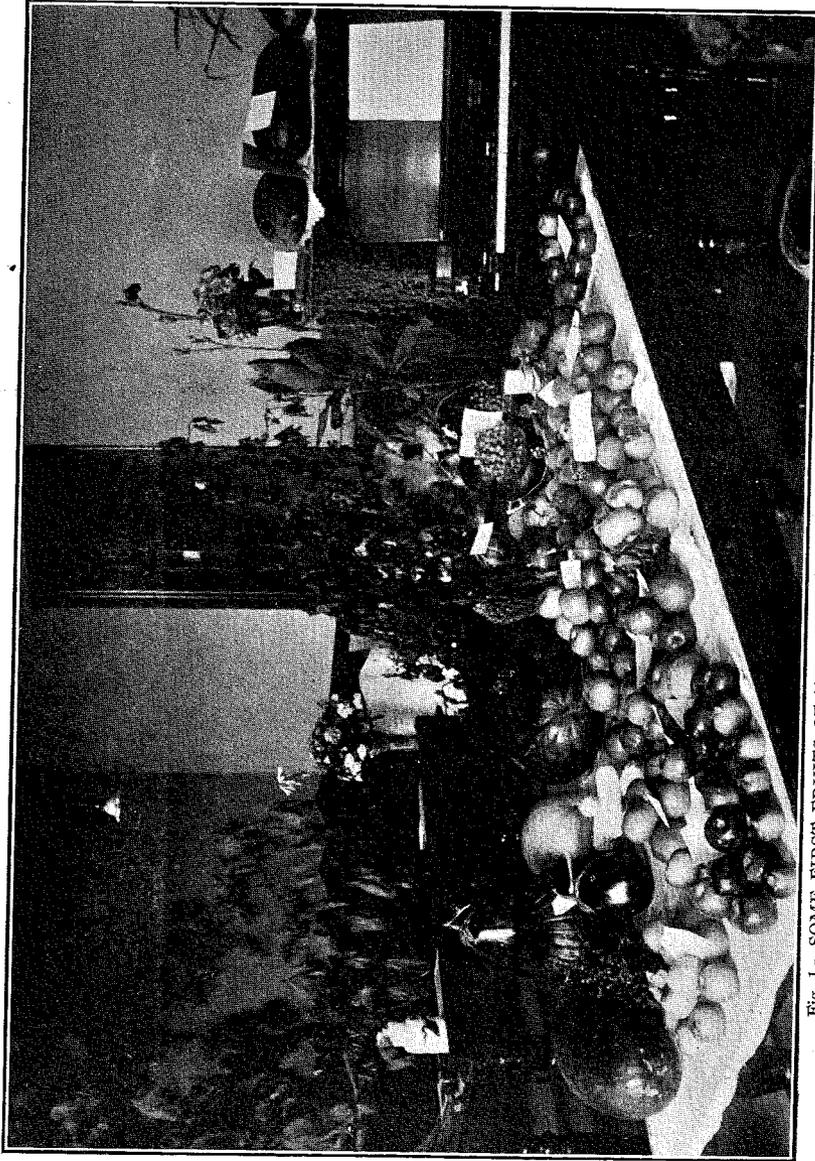


Fig. 1.—SOME FIRST FRUITS OF THE WORK OF THE HORTICULTURAL COMMISSION.
Exhibit at Thatcher, Arizona, August 20, 1912, of apples free from codling moth,—the result of spraying.

ARIZONA HORTICULTURAL COMMISSION FOURTH ANNUAL REPORT

For the Year ending June 26, 1912

The horticultural industries in Arizona have shared the general impetus towards expansion shown in agricultural affairs. This has been especially true of citrus culture in Salt River Valley which, now assured of a dependable water supply through the great reservoir, finds itself able to proceed with confidence in the development of a large area of citrus lands at higher elevations throughout the valley where climatic conditions are most favorable to grapefruit, oranges, and, in some favorable localities, lemons. Deciduous orchards, including peaches, pears, apples, plums and apricots, are being planted at the various altitudes best suited to them climatically, not only in the larger irrigated valleys, but also here and there throughout the State where small developments of water are oftentimes made best use of through the medium of orchard trees.

There are, however, exceptions to this general progress along horticultural lines in the State, due in particular instances to the excessive damage wrought by orchard pests introduced with nursery stock before Arizona was protected by a horticultural law. Chief among these pests is the woolly aphis of the apple, which, making its appearance about eight years ago, has now increased to such an extent in certain apple growing districts as to seriously threaten a profitable industry. In this case, as in others, the "ounce of prevention" vigilantly administered at the proper time (now long since past) would have been worth many "pounds of cure", and would have saved an industry which we now admit is reduced to a condition of threatened failure in some localities.

The codling moth is another instance of a pest that was introduced before Arizona was protected by a horticultural law. The codling moth, therefore, is with us as a permanent, but manageable, problem in connection with the culture of apples and pears throughout Arizona.

Fortunately, however, the horticultural law, and the more recently enacted law creating a Commission of Agriculture and Horticulture, have endowed us with a timely means of shutting out many insect pests and plant diseases which have not yet gained entry to the State.

Commensurately with the growth of fruit interests in the State the Horticultural Commission has extended its service and has endeavored to increase the efficiency of its operations. This has been rendered possible, in part, by an increased appropriation of \$5000.00 for the year's operations made by the Board of Control in the summer of 1911; and by added facility in the execution of the law, due to experience on the part of those charged with its administration. Three new horticultural districts were created during the year, covering more remote sections of the State which the increased appropriation made it possible to reach. Inspectors were appointed for these districts, and the service maintained as usual in parts of the State formerly covered.

The administration of the horticultural law during the year has been carried on with little or no friction and entirely without litigation. The quality of nursery stock brought into Arizona, as shown by the Entomologist's report, has been greatly improved in character and there have been fewer occasions than ever before to cause inconvenience to consignees by the rejection of infested material. It is hoped, therefore, that a continuation of strict and honest administration of the law will decrease both the danger and inconvenience incident to importations of infested materials into the State.

Attention has frequently been called, in the course of the year, to the one-sidedness of the horticultural law, which has to do technically only with horticultural subjects; that is to say, with ornamentals and with crop plants and trees producing only fruits, vegetables and flowers, excluding our great agricultural staples, such as alfalfa, corn, wheat and barley. These great staples, which yield our major agricultural values in Arizona, are no less susceptible to the disastrous action of crop pests than are the strictly horticultural industries, although they are usually more slowly infested, due perhaps to the fact that they are introduced through seed rather than through nursery stock. Especially to be guarded against is the dreaded alfalfa weevil, which has already spread throughout a large irrigated area in Utah, but which, fortunately, so far as we now know, we have an opportunity to quarantine against in Arizona.

On the basis of the experience of the last three years, and in connection with the session of the First State Legislature, the Horticultural Commission spent necessary time in drafting a new law to cover both agricultural and horticultural interests in Arizona. This law, with its amendments, was passed with an appropriation designed to make it effective, and became operative August 16, 1912.

THE NEW LAW

Various new features of this extended and remodeled Act are as follows: (1) The law covers both agricultural and horticultural interests, thus making it possible to utilize it for operations against crop pests of any kind. (2) The Director of the Agricultural Experiment Station is made ex-officio a member of the Commission of Agriculture and Horticulture, thus bringing these two organizations into definite relations with each other. This makes it convenient and desirable for the Entomologist, appointed by the Commission, to act as Entomologist of the Experiment Station, and otherwise harmonizes two organizations between which at all times co-operative relations should exist. (3) The Entomologist, appointed by the Commission, is required to give bond and take oath of office; and his assistants and the inspectors are required to take oath for faithful performance of duty. These provisions make regularly qualified officers of the Entomologist, his assistants and the inspectors and improve their standing in the execution of the law. (4) The Entomologist and his assistants are given the authority of inspectors in any and all districts of the State, so that in emergency they may act as inspectors at any point in Arizona. (5) It is specified that **when** necessary the destruction of pests may include the destruction of the infested articles on which they occur. It is also specifically stated by whom and in what manner the destruction of infested shipments shall be effected. (6) Prohibition is placed on the sale or exchange of infested fruit, or plants, including those infested with codling moth, thus making it possible to restrict the spread of dangerous infested materials from point to point within the State. (7) A special section is devoted to quarantine against the alfalfa weevil and to the initiation of measures against this pest in the event of its appearance in Arizona, a special appropriation of \$1500.00 being made for this purpose. (8) An annual appropriation of \$12,000.00, in addition to that provided for the alfalfa weevil, makes it possible to administer the new law much more

effectively and on a more general scale than was possible with the limited sums available under the old law.

It is possible that, in time, with the development of special local problems in crop pest control in different sections of the State, further amendments to the Crop Pest Law should be secured, creating county organizations to supplement and intensify, locally, the work of the Commission, whose funds and personnel may, presumably, not always be equal to the growing requirements of the general field.

Following is the text of the new law, introduced March 29, 1912, in the First State Legislature by Mr. W. W. Pace; signed, as amended, by Governor G. W. P. Hunt, May 24, 1912; effective August 16, 1912:

AN ACT

To Amend an Act Entitled "An Act to Create and Establish a Horticultural Commission and to Further and Protect Horticultural Interests of the Territory of Arizona," Approved March 11, 1909; and to Create a Commission of Agriculture and Horticulture; and Providing Appropriation for Its Maintenance and Operation.

Be it Enacted by the Legislature of the State of Arizona:

Sec. 1. That an Act entitled "An Act to Create and Establish a Horticultural Commission and to Further and Protect Horticultural Interests of the Territory of Arizona," approved March 11th, 1909, be and the same is hereby amended to read as follows:

Sec. 2. The Governor is hereby authorized to appoint, within thirty days after the taking effect of this Act, two members of a Commission which is hereby established, consisting of three members, who shall be residents of the State of Arizona, to be known as the Arizona Commission of Agriculture and Horticulture. Two members of this Commission shall be the owners of orchards, or groves of fruit trees, or vineyards, or of cultivated agricultural lands, within the said State, and shall be appointed by the Governor to hold office, one for a term of two years, the other for a term of three years, and until their successors, who shall hold office for a term of two years each, are appointed by the Governor, and have qualified. The Director of the Agricultural Experiment Station shall be, ex-officio, the third member of the Commission, or in the event of his inability to act, some other member of the Experiment Station Staff who shall be appointed by the Governor at the time of the appointment of the other two members, for a term not to exceed two years in length. Before entering upon the duties of his office, each and every Commissioner shall take and subscribe to an oath, before some person authorized to administer the same, that he will faith-

fully and impartially perform the duties of his office, which shall be filed in the office of the Secretary of State. Each Commissioner shall furnish a bond to the State of Arizona, to be approved by the Governor, in the sum of five hundred dollars (\$500.00), for the faithful performance of his duty, which bond shall be filed in the office of the Secretary of State. Any Commissioner may be removed by the Governor for cause.

Sec. 3. Within fifteen days after the notice of their appointment, the persons first appointed as the "Arizona Commission of Agriculture and Horticulture" shall qualify as hereinbefore provided, and shall meet and organize by the election of one of their number as chairman, who shall serve as such Chairman for a period of one year, and until his successor is elected. The Commission shall also at such meeting elect one of their number as Secretary and Treasurer, who shall qualify by furnishing the State of Arizona an additional bond in the sum of five hundred dollars (\$500.00), which bond shall be approved by the Governor, and shall be filed in the office of the Secretary of State. Such Secretary and Treasurer shall hold office for a period of one year, and until his successor is elected and qualified.

Sec. 4. The said Commission shall hold annual meetings at such times as shall be fixed by the Commission, at which meetings the Chairman and the Secretary and Treasurer shall be elected, and such other business shall be transacted as the agricultural and horticultural interests of the State shall require. Special meetings may be held from time to time upon call of the Chairman, or of any two members of said Commission.

Sec. 5. At the close of each fiscal year the Commission shall make an annual report to the Governor of the State.

Sec. 6. The duties of said Commission shall be to advance and protect the agricultural and horticultural interests of the State, and for that end, they may appoint an Entomologist, and such assistants and inspectors as may be necessary and they may establish agricultural and horticultural districts within the state. They may employ clerks and other persons and may discharge such employees at will, and incur such expenses as may be necessary or proper to carry out the provisions of this Act. They shall determine the compensation and tenure of office of the Entomologist, assistants, and inspectors, and may remove them from office at will.

The Commission may quarantine against other countries, States, counties districts, or localities, known to be infested with dangerous agricultural or horticultural crop pests or diseases and they may promulgate such rules, regulations, and restrictions, governing the shipment of plants, fruits, or articles from foreign countries, other States and Territories, and counties and districts within such States and Territories, or between districts or localities within the State of Arizona, as the said Commission may deem necessary for the protection of the agricultural and horticultural interests of the State of Arizona, or any section thereof, against any injurious insect, plant disease, or other pest, and such other rules and regulations as they may deem necessary to protect said interests.

Sec. 7. The Entomologist shall be qualified by scientific training and practical experience for the performance of the duties hereinafter prescribed.

The duties of the Entomologist shall be to act as expert adviser to the said Commission and to their appointees, in matters relating to injurious insects,

plant diseases, and other pests; and he shall supervise the work of the assistants and of the inspectors, and shall carry out the purposes and intent of the law, and all provisions, rulings, and orders of the Commission, made in accordance with this law. Said Entomologist and assistants are hereby given all authority granted to the various inspectors under the provisions of this law. Each of them shall take and subscribe to an oath before some person authorized to administer the same, that he will faithfully and impartially perform the duties of his office, and the Entomologist shall furnish a bond to the State of Arizona to be approved by the Governor in the sum of five hundred dollars (\$500.00), for the faithful performance of his duties, which oath and bond shall be filed in the office of the Secretary of State.

Sec. 8. The Inspectors are hereby authorized, and it is their duty whenever the occasion may arise, to enter in and upon any premises, building, or place, where plants may be growing, or vegetables, fruits, seed, and agricultural products, or any article connected with handling, packing, and shipping of the same, may be stored, for the purpose of inspecting, or causing an inspection to be made, to determine whether any injurious pest is present. To this end, and otherwise to carry out the provisions of this Act, said inspectors may open any car, box, bundle, or package with the least possible injury to property or business. Whenever an inspector discovers a pest which is injurious to the agricultural or horticultural interests of the State, and which it is practicable to eradicate or suppress, he may, with the advice and under the direction of the Entomologist or his assistants, notify in writing the owner, owners or person or persons, in charge or in possession of the premises, buildings, or places as aforesaid, that the same are infested or contain or harbor an injurious insect or other pest, and said inspector may require such person or persons to eradicate, destroy, or suppress such pest within a reasonable specified time by means of the most economical and effective method available. In the case of the codling moth, this provision shall apply to trees and orchards on, and in which, infested fruit has been discovered by the said inspector, or his predecessor, at any time previous to the serving of the aforesaid notice.

Any and all such plants, fruit, vegetables, seed, agricultural products, or other articles, infested by or harboring an injurious insect (insect) or other pest are hereby adjudged and declared to be a public nuisance and shall be contraband pending action taken in compliance with the aforesaid notice or action taken by the inspector as herein authorized and directed, and shall remain contraband until said nuisance is abated. Whenever any such nuisance, practicable to abate, shall exist within the jurisdiction of any inspector, on the property of any non-resident, or any property the owner or owners of which cannot be found by the said inspector after diligent search and publication of said notice in the official newspaper of the county where such nuisance exists, or on the property of any owner or owners upon whom notice aforesaid has been served, and who shall refuse or neglect to abate the same, or who shall in writing request the said inspector to take such action as may be necessary at his or their expense, it shall be the duty of the inspector, and he is hereby authorized, to cause said nuisance to be at once abated in a summary manner, or to take such steps towards the abatement of the nuisance as the danger to agricultural and horticultural interests and the welfare of the community may require. Whenever the circumstances require, the abatement of such public nuisance may in-

clude the destruction of the plants, vegetables, fruit, seed, agricultural products, or other articles, infested by an injurious insect, or harboring an injurious insect or (or) other pest, or any portion of any or all such articles as may be necessary to the public interest.

The expense incurred in connection with such action, unless voluntarily assumed by the owner or owners of the aforesaid property, shall be charged against the State, and paid out of the fund authorized by this Act upon vouchers of the Commission. Except that when special provisions are made for the eradication or control of specified pests, any and all such sums so paid, shall be charged against the owner or owners of the property and premises from which such nuisance has been removed or abated in pursuance of this Act and shall be recovered by the State or county as the case may be by a civil action against such owner or owners.

In the case of shipments of plants, fruits, vegetables, seeds, or agricultural products, or other articles received into the State of Arizona from outside said State conforming to the requirements of Sec 9 of this Act, and due notice given as specified in Section 14, the inspector detailed by the Commission for service at the station, depot or other point where such shipment is received, shall inspect the plants, fruits, vegetables, seed, agricultural products, or other articles as soon as possible after receiving said notice. Upon completing the inspection of a shipment, and finding it free from any insect or other pests, the inspector shall issue a certificate of release in duplicate, the original to be given the common carrier, or person or persons, bringing the shipment into the State, and the duplicate to be given to the consignee or person who received and removes the shipment or portion thereof from the premises where inspected. A special certificate of release affecting only a portion of any shipment may be issued when said shipment is found to be infested in part, and owing to the nature of the pest found therein, agricultural and horticultural interests of the State of Arizona, or of the locality where received, will not be endangered by authorizing, by means of said special certificates the delivery and removal of certain varieties or kinds of plants, fruits, vegetables, seeds, agricultural products, or articles contained in said shipment. In the case of shipments containing insects or other pests of common occurrence in the State of Arizona, or in the locality where received, or pests which for any reason are known to be innocuous in Arizona, or in the section of the State where received, certificates of release may be issued by a horticultural inspector in accordance with specific instructions furnished said inspector by the Entomologist, and such rules and restrictions as may be adopted by the Commission of Agriculture and Horticulture.

Sec. 9. All nursery stock shipped into Arizona from any other State or country shall be prominently labeled with the name and address of both the shipper and consignee, and shall be accompanied by a certificate of inspection dated within one year, or a copy of such certificate, by a duly authorized official of the State or country in which said stock was grown. All shipments from other States or countries into the State, consisting of or containing plants, fruits, vegetables, or seeds, which were not grown in the locality from which shipment was made, must, in addition, specify where such plants or products were grown. Shipments into the State of Arizona shall conform to any rules or regulations promulgated by said Commission.

FOURTH ANNUAL REPORT

Sec. 10. For the purpose of carrying out the provisions of this Act, the sum of twelve thousand dollars (\$12,000 00) is hereby appropriated annually. All vouchers for the expenditure of money under the provisions of this Act must be signed by the Chairman and one other member of the Commission, and attested by the Secretary; and the State Auditor, upon the presentation of such vouchers, shall draw his warrant upon the State Treasurer for the payment of the same, and the State Treasurer shall pay such warrant out of any money on hand appropriated for the purpose herein set forth; Provided, that every voucher must set forth the purpose for which the money is used; and Provided, also, that all the money remaining in the hands of the Secretary and Treasurer of the said Commission on the 30th day of June of each year, shall be paid into the State Treasury to the credit of the Arizona Agricultural and Horticultural Commission, to be subsequently drawn out as hereinbefore provided.

Sec. 11. Each of the members of the said Commission shall receive a salary of three hundred dollars (\$300 00) per annum, payable monthly.

Sec. 12. No Commissioner shall, either directly or indirectly, be interested in any contract made by the Commission, and all such contracts shall be utterly void.

Sec. 13. No expenditure shall be made, or indebtedness contracted, in any one year, in excess of the amount therein appropriated.

Sec. 14. When, within the judgment of the said Commission, or a majority of the members thereof, the importation from designated countries, States, counties, districts, or localities, of specified varieties of plants, fruits, vegetables, seeds, agricultural products, or other articles, is dangerous to the agricultural or horticultural interests of Arizona because of the likelihood of infestation with crop pests or diseases, the said Commission may declare quarantine against all such varieties of plants, fruits, vegetables, seeds, agricultural products, or other articles, from such designated countries, States, counties, districts, or localities; and all common carriers concerned shall be immediately notified (notified) of all declarations of quarantine, and are hereby prohibited from bringing quarantined plants, fruits, vegetables, seeds, agricultural products, or other articles, from such designated places, into the State.

Any person or persons, firm, corporation, or common carrier, who shall bring, or cause to be brought, into the State, any plants, fruits, vegetables, seeds, agricultural products, or other articles herein provided for, shall immediately after the arrival thereof, notify the inspector detailed by said commission to act at the depot, station, or place, where the same may be received, and hold the same without unnecessarily moving or placing such articles where they may be harmful, for the immediate inspection of such inspector, and shall not deliver same until furnished with a certificate of release by the said inspector. The members of said Commission, the Entomologist, or the inspector, are hereby authorized and empowered to enter into any warehouse, depot, or any other place, where such nursery stock, fruits, or agricultural products, or other described articles, are received, for the purpose of making the investigation or examination herein provided for.

Sec. 15. When any shipment of plants, fruits, vegetables, seeds, agricultural products, or other articles, imported or brought into the State is found to be infested by, or to harbor insect or other pests dangerous to the interests of

the State, or a section thereof, or when any portion of such shipment is so infested, or harboring any species of dangerous pests, the Entomologist or inspector shall notify the shipper, consignee, or owner, and shall require the shipper, consignee, or owner, immediately to reship from the State, or immediately destroy such shipment, in whole or in part as said inspector may deem necessary, at the option of the owner, owners, agent, or agents and at his or their expense. In the event that the shipper, consignee, or owner shall neglect or refuse to reship from the State, or destroy, such infested shipment or portion thereof, the Entomologist or inspector shall destroy, or cause to be destroyed, by fire or otherwise, such infested shipment or portion of shipment.

Sec. 16. Wherever in this Act the word "pest" occurs it shall be construed to include any stage in the development of any insect, mite, red spider, or other animal, and any plant disease due to a fungus, bacterium or other organism, or to an unknown cause, which is destructive, or likely to be destructive, in Arizona to any cultivated plant or product of such plant.

Wherever in this Act the word "plant" occurs, it shall be construed to include any tree, bush, shrub, vine, cutting, graft, bud, or scion, intended for the planting and propagating of fruits, vegetables, or other plant products, or for ornamental purposes, or which has been, or may be at any time, used for such purposes.

Wherever in this Act the term "nursery stock" is used, it shall be construed to include ornamental or fruit producing trees, shrubs, and perennial vines which are commonly considered as nursery stock, and which are commonly inspected and certified by official horticultural inspectors of other States.

Wherever in this Act the term "shipment" is used, it shall be construed to include whatever is brought into the State of Arizona or transported within the State by common carriers under one bill of lading, way bill, or express billing, and shall also include all plants and plant products brought into Arizona at any one time by any one conveyance or means other than by common carriers.

Sec. 17. It shall be unlawful to offer for sale, sell, give away, or transport, except from the State as provided in Sec. 15 of this Act, any plants, fruits, vegetables, or seeds, known to be infested by dangerously injurious insects or infested with dangerously (dangerously) injurious plant diseases, or known to harbor any pest whatsoever, provided that in the case of apples or pears infested by the codling moth, plain evidence of injury by this insect to any such fruit or fruits shall constitute a condition of infestation, and whenever in the judgment of said Commission the protection of horticultural interests of any section of the State requires such action, fruit commonly known as "wormy" together with all other apples or pears in the same package, box, barrel or lot, together with the box, boxes, barrel, barrels, or other containers, shall be declared a public nuisance and contraband by the Entomologist, assistant, or any inspector, and the offering for sale, selling, giving away, or transporting, of such fruit after such declaration shall be unlawful.

Sec. 18. In order to prevent the introduction into, or the spread within, the State, of the insect pest known as the 'alfalfa weevil,' now existing in neighboring states, the Commission of Agriculture and Horticulture is hereby given authority to prohibit the introduction of packages or boxes of fruit, vegetables, hay, or other farm products, or any material or articles likely to contain or harbor said pest, from any State, county, district, or locality,

where the said alfalfa weevil may exist. Said Commission may promulgate any rules it may deem advisable restricting shipments from countries, States, or counties, districts, or localities, known to be infested by the said alfalfa weevil, into Arizona, by common carrier or otherwise. In the event that the alfalfa weevil becomes introduced into Arizona, the Commission and the Entomologist shall take whatever steps may be practicable to eradicate or restrict the spread of said pest. The sum of fifteen hundred dollars (\$1500.00) is hereby appropriated as an emergency reserve fund to be drawn upon by the Commission in the regular manner for the purpose of carrying out the provisions of this Section, if the necessity arises.

Sec. 19. Any person, persons, or corporation violating any of the provisions of this Act or interfering with its administration is guilty of a misdemeanor.

Sec. 20. All Acts and parts of Acts in conflict herewith are hereby repealed.

Approved May 24, 1912.

OFFICIAL ACTS OF THE COMMISSION

Six meetings were held in the course of the year, as follows:

1. Adjourned meeting, Commercial Hotel, Phoenix, Arizona, August 1, 1911.

A schedule of expenditures to the amount of \$5000.00 for the fiscal year beginning July 1, 1911, was outlined. A. W. Morrill was re-appointed Entomologist of the Horticultural Commission at a part salary of \$1800.00 for the year. The Secretary and Treasurer of the Commission was empowered to employ a clerk at a salary of \$150.00 per annum; and the office of the Horticultural Commission was removed to the Board of Trade building, Phoenix, Arizona, and its rental provided for. The annual reports of the Commission, and of the Entomologist, were read and ordered printed.

2. The regular annual meeting was called according to law November 7, 1911, Agricultural Building, Territorial Fair, Phoenix, Arizona, and adjourned to November 9, 1911.

3. Adjourned meeting, office of the Horticultural Commission, Phoenix, Arizona, November 9, 1911. The Entomologist made a verbal report relating to conditions in the deciduous districts of northern and eastern Arizona, and suggested measures for the protection of uninfested localities.

Horticultural District No. 1 was made to include all that portion of the country lying above the town of San Jose, in Graham and Greenlee counties, irrigated by the waters of the Gila river and its tributaries; and especially including all railway, stage and other common carrier stations within such designated country.

Also, new Horticultural Districts were constituted as follows:

District No. 4: To include the irrigated or cultivated lands of Yavapai County, the adjacent portions of the Verde River watershed in other counties, together with the town of Flagstaff as a point of entry, and especially including railway, stage and other common carrier stations within said district.

District No. 5: To include the drainage area of the Little Colorado river and its tributaries above Holbrook in Apache and Navajo counties, and especially including all railway, stage and other common carrier stations within said district.

District No. 6: To include Sulphur Springs, San Pedro and San Simon valley drainages in Cochise county, and especially including all railway, stage and other common carrier stations within said district.

The Entomologist reported that a general inspection of two-thirds of the citrus orchards of District No. 2 had thus far failed to discover white flies, red scale, yellow scale, citrus mealy bugs, purple scale, red spider, six-spotted spider, or rust mite in the district. Soft scale, orange thrips and an injurious ant were found, in some cases causing noteworthy damage.

4. Adjourned meeting, Phoenix, Arizona, Jan. 6, 1912. A general discussion was held relating to citrus conditions in Salt River Valley, especially in connection with recent cold weather; and the effect of cultural methods, and planting of alfalfa in orchards, upon early maturity of fruit and upon severity of frost effects.

F. H. Rockwell was continued as Chairman of the Commission, and R. H. Forbes was continued as Secretary and Treasurer thereof.

5. Adjourned meeting, office of the Horticultural Commission, Phoenix, Arizona, February 21, 1912.

Upon recommendation of Entomologist Morrill, quarantine inspectors were appointed as follows:

District No. 2, Richmond Peeler, Chandler, Arizona.

District No. 4, L. L. Bates, Prescott, Arizona.

District No. 5, S. D. Smith, Holbrook, Arizona.

District No. 6, E. P. Grindell, Douglas, Arizona.

District No. 6, J. H. Jaque, Bowie, Arizona.

The revision of the law in preparation for the first session of the State Legislature was entered upon, with assistance of counsel employed for the purpose by the Commission, and resulting manuscript committed to the Secretary to draft for future consideration.

6. Adjourned meeting, Entomologist's office, Phoenix, Arizona, June 3 and 4, 1912.

Andrew Kimball was elected Chairman of the Commission, beginning June 3. R. H. Forbes was continued as Secretary and Treasurer of the Commission.

Plans and operations under the new Commission of Agriculture and Horticulture law were discussed, and a tentative program of measures was outlined for the first meeting of the Commission under the new law, such actions to be finally passed at that meeting.

Sixty days leave of absence, beginning June 10, being one month each for 1911 and 1912, was granted to Dr. A. W. Morrill.

A schedule of expenditures under the appropriation granted in the new law was discussed and tentatively adopted for final action at the time of the first meeting under the new law.

PERSONNEL OF THE COMMISSION

The personnel of the Horticultural Commission, and its appointees, for the year is as follows:

The Commission until April 26, 1912, consisted of:

Foster H. Rockwell, Phoenix, Arizona; Chairman.

R. H. Forbes, Tucson, Arizona; Secretary and Treasurer.

Andrew Kimball, Thatcher, Arizona; Member.

Dr. A. W. Morrill was continued for the year as Entomologist of the Commission; and the following Inspectors have served for a whole or a part of the year:

District No. 1.—R. E. L. Wixom, Thatcher, Arizona and
W. O. Wheatley, Clifton, Arizona.

District No. 2.—George Acuff, Phoenix, Arizona;
F. H. Simmons, Tempe, Arizona;
W. K. Bowen, Mesa, Arizona;
Charles Sellers, Mesa, Arizona;
Richmond Peeler, Chandler, Arizona.

District No. 2.—E. L. Crane, Yuma, Arizona.

District No. 4.—L. L. Bates, Prescott, Arizona.

District No. 5.—S. D. Smith, Holbrook, Arizona.

District No. 6.—E. P. Grindell, Douglas, Arizona and
J. H. Jaque, Bowie, Arizona.

In addition to these regular appointments, office and field assistance has been secured from time to time as the work required.

FINANCIAL STATEMENT

The following statement of expenditures by schedules and by districts shows the nature and distribution of such expenditure for the year. The column headed "General" is for the benefit of all sections of the State alike, while those expenditures listed under various districts more particularly apply to those districts:

CLASSIFIED EXPENDITURES FOR THE YEAR ENDING JUNE 30, 1912

Abstract	General	District No. 1	District No. 2	District No. 3	District No. 4	District No. 5	District No. 6	Totals
1a Salaries	\$2177.79	\$3 49	90.70					\$2181.28
1b Scientific		73.45	90.70					164.15
1c Inspection		144.10	400.52	95.48	155.75	37.68	15.57	849.10
2 Labor	5.40		3.00					8.40
3 Publications	216.99							216.99
4 Post. & Stat.	190.66		46.30	4.01	25		25	241.47
5 Frt. & Express	9.88	5.30						15.18
6 Heat, Lt., Wtr	4.50							4.50
7 Scientific App.	34.95	52.33	5.00					92.28
8 Sundry Sup.	43.92							43.92
9 Books, etc.	23.70							23.70
10 Furn., Of rent	332.27							332.27
11 Travel. Exp.	578.46	85.00	59.80		46.20		2.30	771.76
12 Miscellaneous	55.00							55.00
<i>Totals.....</i>	<i>\$3673.52</i>	<i>\$363.67</i>	<i>\$605.32</i>	<i>\$99.49</i>	<i>\$202.20</i>	<i>\$37.68</i>	<i>\$18.12</i>	<i>\$5000.00</i>

ANDREW KIMBALL,
Chairman.

R. H. FORBES,
Secretary-Treasurer.

W. K. BOWEN,
Member.

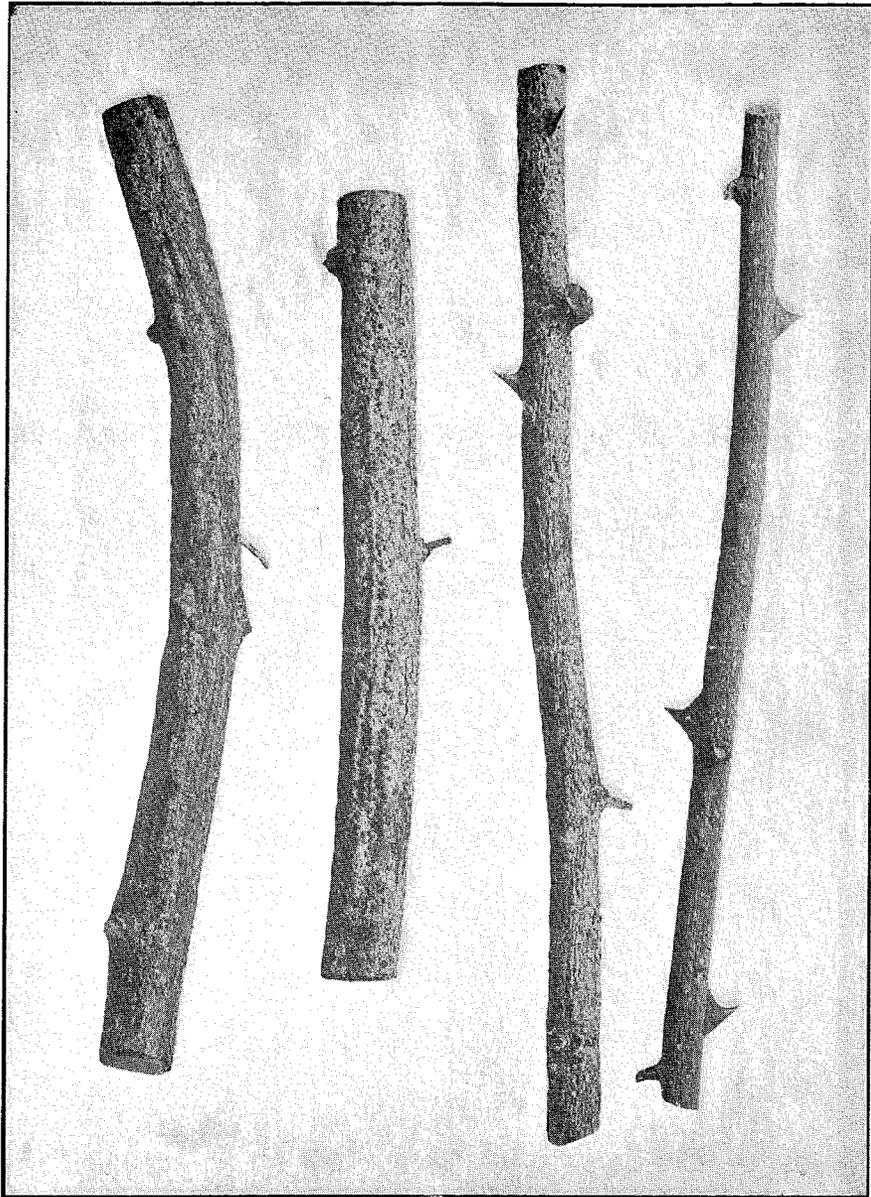


PLATE I.—PARTS OF ROSE BUSH INFESTED BY CALIFORNIA RED SCALE (*CHRYSOMPHALUS AURANTI*)

Found in Phoenix, Ariz., June, 1912. See pp. 19, 24, 40. (Original).

REPORT OF THE ENTOMOLOGIST OF THE ARIZONA HORTICULTURAL COMMISSION

For the Year ending June 30, 1912.

The work of the Entomologist during the past fiscal year and of the inspectors who have acted under his advice and direction is reviewed in Part I of this report. In Part II, following the plan adopted in the preceding report, notes are presented concerning insects notably injurious in Arizona during the year, with a discussion of insect menaces or pests which need to be especially guarded against; also a discussion of the amended Crop Pest Law and the benefits to the State to be derived therefrom.

PART I

REPORT OF INSPECTIONS

The work of inspecting imported plants has been greatly extended during the past fiscal year so that nearly all sections of the State having well developed or partially developed fruit growing interests have been afforded protection. Altogether 882 shipments were inspected during the fiscal year. This is an increase of forty-two percent over the preceding fiscal year. The increase is due to the extension of the inspection service by the creation of new Horticultural Districts, the number of shipments inspected in the three previously established districts remaining practically the same for the two years.

Thirty-seven shipments were found by the inspectors to be infested with injurious insects as compared with thirty-nine shipments for the previous year. The percentage of infested shipments (in whole or in part infested) has continued to show a marked decrease under the influence of the Horticultural Law. The successive records of the percentage of infested shipments for the three years of the law's operation now stand as follows: 1909-10, 8.2 percent; 1910-11, 6.2 percent; 1911-12, 4.2 percent.

SUMMARY OF INSPECTIONS, FISCAL YEAR ENDING JUNE 30, 1912

District number	Releases issued for entire shipment	Releases issued for portion of shipment	Releases not issued	Total shipments inspected
1.....	80	5	2	87
2.....	490	14	5	509
3.....	123	1	3	127
4.....	112	0	3	115
5.....	13	3	0	16
6.....	28	0	0	28
Total.....	846	23	13	882
Percent.....	95.8	2.7	1.5	

In addition to the foregoing, two shipments came into the State which were found to contain plants quarantined against by the Horticultural Commission on account of the danger of introducing insect pests. One shipment of privet from Alabama—a food plant of the citrus white fly from a state where the insect is quite widely scattered—was received in District No. 1 and finally destroyed at the request of the shipper. A shipment of fruit trees from a locality in Florida known to be infested by this insect was received at Yuma. This shipment contained citrus trees together with other kinds of fruit trees which were not subject to infestation by white flies and which proved upon inspection to be free from pests. The citrus trees were returned to the shipper and the remainder of the shipment released.

The eastern peach borer (*Sanninoidea exitiosa*), as during the preceding year, was the leading pest found by inspectors in imported shipments. Several species of aphid or plant lice ranked second. The complete record is as follows: Shipments infested by peach borer (*Sanninoidea exitiosa*), 16; by plant lice, 13; by greedy scale (*Aspidiotus rapax*), 3; by red spider (*Tetranychus sp.*), 2; by yellow scale (*Chrysomphalus citrinus*), 1; and by mealy bugs (*Pseudococcus longispinus*), 1.

INSPECTION PRACTICES

During the first two fiscal years of the operation of the Horticultural Law of 1909, 1095 shipments of plants were inspected in the three districts to which the work was confined. These shipments were received from 25 states and territories and one foreign country and were consigned by 198 different nurserymen and florists,

with comparatively few in addition by persons not regularly engaged in the nursery or the florist business. The requirements of the inspection laws in different states and the inspection practices which are followed differ greatly, due in part to differences in local conditions and in part to imperfections of the laws. Much confusion naturally exists among nurserymen and florists who make interstate shipments, since an insect which may properly be considered a pest and worthy of much attention by inspectors in one state may have the standing of a necessary evil in other states where it is of general occurrence.

Two years' experience having shown that most of the infested shipments were from nurserymen and florists who lacked information concerning the Arizona law, and inspection practices, a circular of information (No. 16) was prepared to meet the need indicated. This circular was placed in the hands of the shippers early in the season, and undoubtedly much of the improvement shown in the past season's inspection reports, as compared with the previous season, was due to this method of gaining publicity concerning our requirements. Another important benefit arising from the publication was the reaching of the official inspectors in other states with information concerning Arizona inspection practices and the conditions which govern them. The third object of the circular was to serve as a guide to Arizona inspectors, making the inspection practices in the horticultural districts as uniform as possible under diverse conditions.

The diversity of conditions and crops within the State of Arizona constitutes a situation unequaled in any other state in the country except California. The protective requirements of Arizona are, however, differentiated in many particulars from those of California by the comparative newness of the agricultural and horticultural industries and the isolation of the leading cultivated districts. The adoption of inspection practices in the different districts of Arizona giving maximum protective benefit and avoiding unwarranted and useless interference with the development of agricultural and horticultural interests has been the leading problem confronting the Entomologist. These practices as set forth in Circular 16 are, owing to the conditions referred to, more strict as a whole than the practices of inspectors in other states. Nevertheless, numerous favorable comments on the fairness and reasonableness of the practices adopted have been received from prominent nursery and florist firms in various parts of the country, including

some who have had shipments or parts of shipments condemned by Arizona inspectors.

INSPECTION OF FRUIT

The inspection of fruits imported into the State is secondary in importance as a protective measure to the inspection of nursery stock and other live plants. For purely commercial reasons, as it

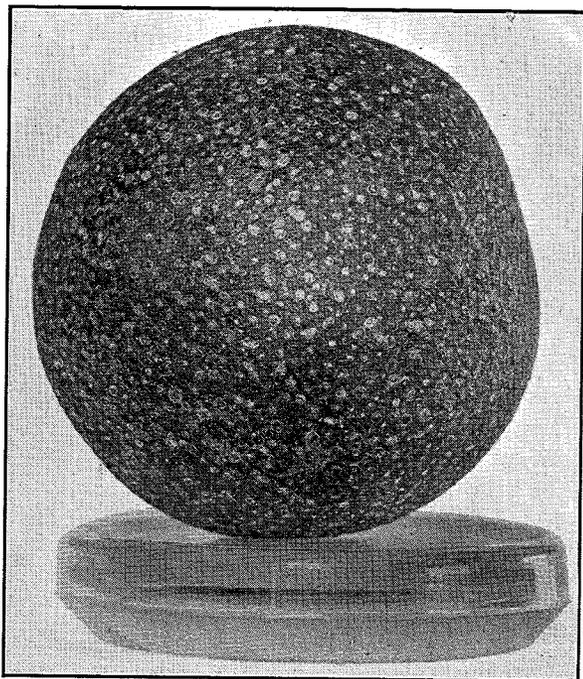


Fig. 2.—Red scale (*Chrysomphalus aurantii*) on orange in shipment from Mexico to Arizona. (Original)

in infested sections and sold in bulk without being commercially sorted and packed, than by importations from other states.

The danger of the introduction and establishment of injurious scale insects on deciduous fruits is comparatively slight owing to the nature of the parings and the fact that such refuse is seldom disposed of in such manner as to permit the young insects to reach food plants. Citrus scales, however, constitute a much greater danger when introduced on fruit. This is due principally to the less perishable nature of the fruit and to the fact that the citrus fruit

appears, codling moth infested apples and pears are seldom found in importations from other states. One exception has been noted in the case of fruit brought into Douglas, Arizona, from a neighboring portion of New Mexico. The uninfested apple and pear orchards of Arizona are menaced incomparably more by fruit grown within the State

rinds are likely to sustain the insects for a longer period than deciduous fruit refuse.

Owing to the foregoing considerations, questions as to the adequacy of the law of 1909 to control the matter, and the insufficiency of funds, no active work was undertaken in checking the introduction or distribution within the State of infested fruit during the first two years of the law's operation. During the last fiscal year, however, a beginning has been made in the development of this line of horticultural protection. The requirements of different sections of the State have been investigated, wholesale fruit dealers have been interviewed, warning notifications have been sent to the shippers concerned, and scale infested citrus fruit from Mexico and California has been condemned. The condemned fruit consisted of sixty-seven boxes of California oranges and eighteen boxes of oranges from Sonora, Mexico, infested by red scale (*Chrysomphalus aurantii*), an especially menacing pest which is discussed elsewhere in this report.

ORCHARD INSPECTION

A reasonably thorough tree by tree inspection of all the citrus orchards in the State is recognized as very desirable and the expenditure such an inspection would require would be justifiable as an economical protective measure. The practice of tree by tree inspection adopted three years ago in an important citrus district in California, believed to be for the most part as free from scale insect pests as are the citrus orchards of Arizona, resulted in the discovery of incipient colonies of four species of citrus scales in various localities. Concerning the importance of tree by tree inspections, Horticultural Commissioner Essig, of Ventura County, now Secretary of the California State Commission of Horticulture, writes as follows:¹

"In Ventura County the mealy bug was thought to be the only real dangerous pest. Purple and red scales were known to exist in only two localities. A tree to tree inspection located mealy bugs in six localities where it was not known to exist; red scale in two localities and purple scale in two districts miles from the known infestation."

In Arizona, two notable discoveries during the past fiscal year demonstrate in a forceful manner the importance of orchard inspection work to our fruit growing interests, particularly to citrus fruit growers. The first illustrates the fact that colonies of scale insects are

¹ Pomona College Journal of Entomology, Vol. II, p. 294.

apt to become established in unexpected places far from known sources of infestation. A common species (*Lecanium hesperidium*)

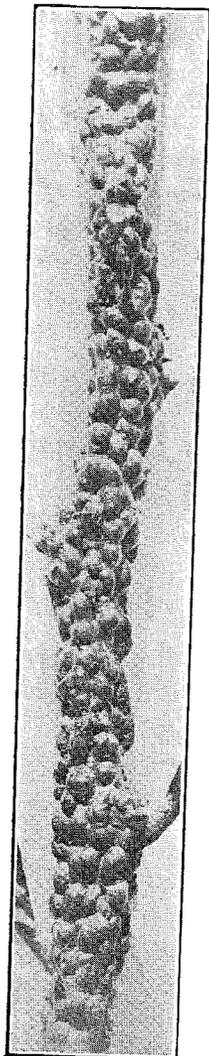


Fig 3.—Soft brown scale (*Lecanium hesperidium*) on orange twig. (From Quayle, Calif. Exp. Sta.)

was discovered by a Salt River Valley orange grower on a single branch of a lemon tree growing in the midst of his orchard. At the time of this discovery the nearest known possible source of the infestation was the infested oleanders in Phoenix about eight miles distant. Recently a few infested oleanders have been found within two miles of the orchard referred to. Careful inspection in this and surrounding citrus orchards have failed to reveal even a single additional specimen of the insect. From the circumstances it appears that the orchard infestation had its origin in crawling larvae transferred from a distance by birds or flying insects. The soft scale is frequently abundant enough on citrus trees in Florida and California to be classed as a pest, but fortunately in Arizona it has so far been found to be negligible as a citrus pest except in the neighborhood of infested oleanders. Nevertheless, the object lesson in the incident is none the less striking. This scale is referred to again in connection with the subject of introductions of beneficial insects.

The second of the two notable discoveries under consideration is one of far greater direct importance. During the last month of the fiscal year the presence of a scale insect on a rose bush in a private garden in the city of Phoenix, was reported to the Entomologist and the matter at once investigated. It was found that the insect was the California red scale (*Chrysomphalus aurantii*), the establishment of which in the citrus growing sections of Arizona has been justly feared by all who are informed concerning this pest and the diverse conditions of climate under which it thrives. The infested rose bush was located so that it was shaded from the midday sun. While

protection from the sun's rays is not considered essential for the development of the red scale, it may be noted that the infested rose bush was no more protected from direct sunlight than the interiors and north sides of citrus trees in bearing orchards.

The older portions of the infested rose bush were completely covered by the scales, and portions of the plant were dead or dying. The evidence of the ability of this important citrus pest to thrive in the citrus growing sections of Arizona could not be more direct or conclusive. As near as can be determined the chances for the red scale to become established in the citrus orchards of Arizona are not less than the chances for rose bush infestation. The discovery, therefore, not only emphasizes the importance of thorough orchard inspection, but shows strikingly the necessity of general inspection of citrus scale food plants grown as ornamentals in town and country gardens.

The funds available for the first three years of the law's operation have not been sufficient to undertake a tree to tree inspection of the citrus orchards. At this time it would cost fully \$2000.00 to make such an inspection of the bearing citrus orchards and possibly \$1000.00 additional to inspect all non-bearing citrus orchards in Arizona. The facts concerning this matter which have been presented here clearly show that this protective measure is one of the immediate needs of the citrus industry in the State. It is hoped that with the funds provided by the First State Legislature it will be possible to make some definite progress with this work.

In the first report of the Entomologist¹ it was stated that a general inspection of all citrus groves had been made during the year. In connection with the citrus thrips investigations, conducted as an Experiment Station project and referred to elsewhere in this report, a second general inspection was made during the last fiscal year. This inspection was supplemented by extensive inspections of citrus fruits at the packing houses. While these inspections were not thorough the indications are very favorable to the citrus industry in Arizona. Except for the colony of red scale found in the city of Phoenix and believed to have been exterminated, no dangerous citrus infesting scale is known to exist in Arizona. Co-operation on the part of the citrus growers in reporting promptly any suspected infestations, and thorough inspection work under the State law with such progress as the funds will permit, should retain for the Arizona citrus industry the existing condition as regards dangerous scale insect pests. This condition is appreciated as the greatest asset of the citrus industry in this State by all who are familiar with the less advantageous situation in California and Florida.

¹ Second Annual Report of the Arizona Horticultural Commission, p. 13.

ALFALFA WEEVIL PROTECTION

Continuing the efforts begun during the preceding year, the Entomologist has contributed numerous articles of information concerning the alfalfa weevil to the press of the State, has secured and exhibited specimens of the insect in all stages at the last Territorial Fair, and has published and posted warning notices concerning the insect in all sections of the State where alfalfa is grown. Specimens of the insect have been furnished to the inspectors in Districts Nos. 1 and 3. Inspector Wixom in District No. 1 has been particularly active in instructing the alfalfa growers of his district concerning the pest. As a result of the interest aroused, many suspected insects have been sent to the Entomologist for identification.

It is important that interest of this kind among alfalfa growers be maintained, that certain restrictions be imposed upon shipments into Arizona of a dangerous nature, such as live stock and household goods from infested localities; also that alfalfa growing districts be kept under constant surveillance by inspectors. These matters were discussed at length in the last report of the Entomologist, since which time provision has been made by the State Legislature for more active work in weevil protection.

INSECT CONTROL

Control work under Section 6 of the Horticultural Law of 1909 has included codling moth control in Horticultural District No. 1; and date palm and California red scale control in District No. 2.

CODLING MOTH

Progress in fighting the codling moth in District No. 1 has been slow but noteworthy. The district inspector reports that banding records show a marked advantage in regularly sprayed orchards over those unsprayed or indifferently sprayed. The codling moth situation in District No. 1 since the Entomologist's first survey of the matter in 1909 has been recognized¹ as one which must be improved gradually. The control of the codling moth in an orchard when an average of ten specimens per tree survive the winter is a simple problem compared with that presented when the average is one hundred per tree. The control work directed by the Entomologist and the District Inspector has not only had to contend with the original

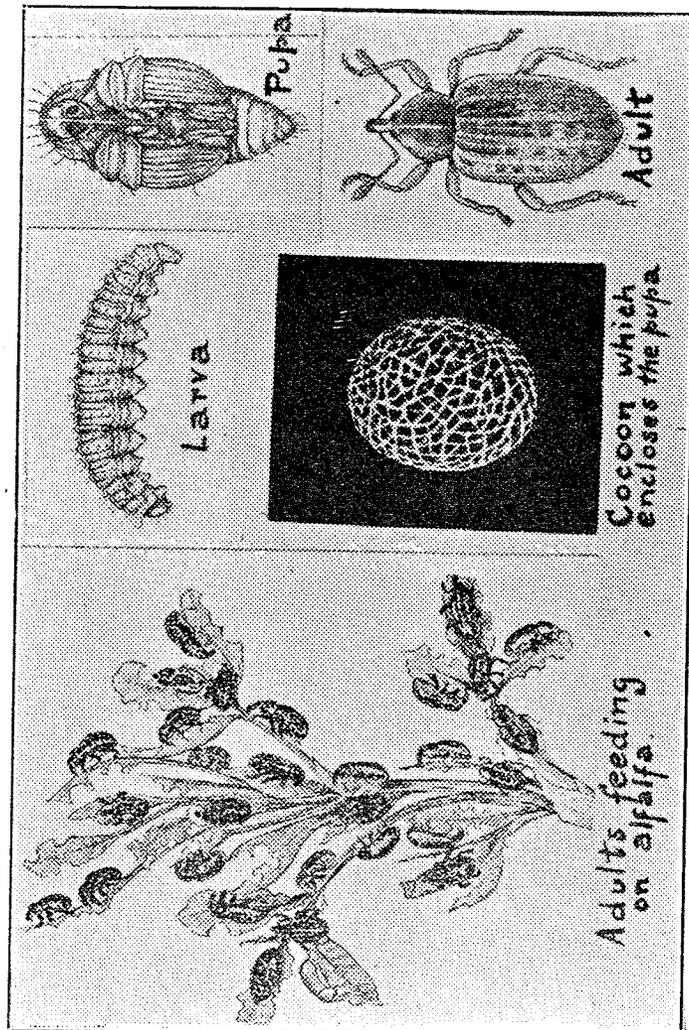


Fig. 4.—Alfalfa weevil. (Adapted from Webster, U. S. Bureau of Entomology.)

¹ Circular 15, Ariz. Hort. Commission, p. 2.

condition of excessive infestation, but with temperature conditions favorable to a high rate of seasonal increase of the insects equalled by few apple growing sections of the country. The effect of temperature conditions in certain northern states is the production of only about 800 worms during the season as the progeny of a single female moth, whereas in District No. 1 in Arizona, with temperature conditions making three generations possible, it is estimated that fruit growers have over 16,000 worms to contend with as the seasonal progeny of one female. The effects of accidental and natural mortality and of poisons are not considered in these figures.

It must be admitted that the conditions in that part of District No. 1 lying in Graham county are unfavorable to commercial apple growing in some respects aside from climatic conditions. The orchards, with few exceptions, occupy a position secondary to alfalfa growing, and are subject to neglect in the details of codling moth control as well as of general care. It is unlikely that results will ever be attained in codling moth control in Graham county comparable with the results secured in colder climates, except at a cost two or three times as great. The advantage of proximity to good markets, however, more than offsets all the disadvantages which exist, for those who maintain apple orchards on the best basis of profit and productiveness.

The results of the work of the season of 1911 have demonstrated several important points in connection with codling moth control in Graham county. No matter how thorough the first two applications may be, late varieties of apples will be badly damaged by this pest if they are not constantly protected by poison. Codling moth control cannot be satisfactorily successful if the trees are too closely planted or interfere with thorough spraying by excessive height or the interlocking of branches when laden with fruit. Banding of trees to trap the worms appears to be an essential feature of the most thorough codling moth control in Graham county. The foregoing and other conclusions from the work of the season of 1911 were embodied in a circular of directions (unnumbered) for combating the codling moth in Arizona. These directions were prepared with the view of supplying information to fruit growers in all parts of the State. They were distributed originally by publication in the newspapers and later in the form of a separate folder. During the first week in April, 1912, a copy of these directions, with a circular letter, was sent to each apple and pear grower in Graham county by District Inspector Wixom.

Banding records were continued throughout the season of 1911 by Miss Rosalind Wixom of Thatcher, and miscellaneous moth records were made by District Inspector Wixom, Miss Wixom and the writer. The work has been continued the present season. The records obtained have already proven of great practical value and advices to fruit growers concerning times to spray for best results have been given in accordance therewith. These records are being obtained at an expense which is very slight considering their value. Their greatest usefulness will be attained by their continuance over a period of several years.

DATE PALM SCALE

Three lots of date palms have been discovered during the past fiscal year to be infested by the date palm scale (*Parlatoria blanchardi*) and have been treated by Inspector Acuff of District No. 2 in accordance with the method of treatment devised by the Agricultural Experiment Station.¹

CALIFORNIA RED SCALE

The discovery of the California red scale (*Chrysomphalus aurantii*) on a rose bush in Phoenix in June, 1912, has been mentioned under the subject of orchard inspection. The infested bush had been introduced from Pasadena, California, previous to the taking effect of the Horticultural Law in 1909. Fortunately, it had not been planted very close to other food plants and with the exception of two or three specimens found on one other rose bush there appeared to have been no spread to other plants. The entire top of the original infested rose bush was destroyed and the infestation is believed to have been completely exterminated.

INTRODUCTION OF BENEFICIAL INSECTS

SOFT BROWN SCALE PARASITES

The soft brown scale (*Coccus hesperidum* Linn.) is not a pest of prime importance, but both in California and in Florida it frequently becomes temporarily injurious to a single tree or to a few trees in a citrus orchard. It is usually brought into a state of control by the

¹ Bulletin 56, Ariz. Exper. Sta.

activity of two common parasites and it is rarely necessary to employ artificial means of suppression. In Arizona this scale has been known for a number of years, being recorded by Professor T. D. A. Cockerell in 1899 in connection with his report on insects of the Salt River Valley.¹ It appears to thrive better in the Salt River Valley than where it has been observed by the Entomologist in



Fig. 5.—Soft brown scale, greatly enlarged, showing exit holes of parasite. (From Quayle, Calif. Exp. Sta.)

either Florida or California. Fortunately it has so far exhibited a peculiarity in Arizona which has prevented serious damage to citrus trees. This peculiarity consists in a favoritism or adaptation to the oleander which restricts its injuriousness. In the Salt River Valley it is rarely found on citrus trees far from infested oleanders. In addition to citrus, fig trees, rose bushes, pepper trees, china trees and many other trees and shrubs are subject to heavy infestation when growing near to infested oleanders. It is quite possible that in the course of time the soft brown scale will become less dependent upon oleander in the Salt River Valley. In view of the fact that no evidence of parasitism had been found in Arizona the Entomologist secured, through the courtesy of Professor H. J. Quayle of the California Agricultural Experiment Station, a good supply of three of the common California parasites of this scale. The species of parasites represented are known scientifically as *Coccophagus lecanii*, *Coccophagus lunulatus* and *Encyrtus flavus*. These beneficial insects were liberated on infested oleanders under very favorable conditions and were observed to become at once active in parasitizing the scale insects. The success of the parasites in establishing themselves has not as yet been determined. If the three species so far introduced do not prove successful, however, one more important one remains to be tested.

¹ Bull. 32, Ariz. Agr. Exper. Sta., p. 285.

CODLING MOTH PARASITES

Parasites of the codling moth have not heretofore proven successful in the control of the pest, but it is not impossible that conditions exist under which parasites might become dominant. Some years

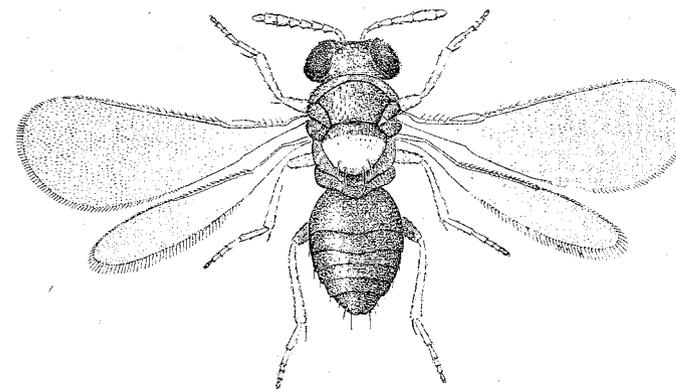


Fig. 6.—Parasite of soft brown scale, *Coccophagus lecanii*. (From Quayle, Calif. Exp. Sta.)

ago the California Commission of Horticulture introduced from Europe an ichneumon parasite of the codling moth known as *Calliphialtes messor*. This species is believed to be the most active codling moth parasite in existence, although it has not so far proven of commercial importance in this country.

Through the courtesy of Dr. A. J. Cook, California State Commissioner of Horticulture, and Prof. E. K. Carnes, Superintendent of the California State Insectary, acting with special permission of their State Board of Control, the Entomologist has secured a supply of the above mentioned codling moth parasites for experimental purposes. These beneficial insects were liberated by District Inspector Wixom on June 10, 1912, in an unsprayed orchard at Thatcher under conditions believed to be favorable to their establishment.

PUBLICATIONS AND PUBLIC ADDRESSES

The following is a list of the principal publications of the Entomologist during the fiscal year covered by this report, exclusive of a few which are not of direct interest in Arizona:

Spraying for the Third Brood of the Codling Moth.

—Southwestern Stockman, July 28, 1911.

An Opportunity for Arizona Citrus Nurserymen.

—Progressive Farmer, August, 1911

Co-operative Marketing and Insect Control.

—Progressive Farmer, September, 1911.

A Suggestion to Those Ordering or Planning to Order Nursery Stock.

—Southwestern Stockman, September 29, 1911.

Report of the Entomologist of the Arizona Horticultural Commission.

—Third Annual Report Ariz. Hort. Comm., pp. 11-33, Oct. 1, 1911.

Our National Lack of Quarantine against Insect Pests and the Bill Designed to Remedy this Condition.

—Progressive Farmer, October, 1911.

Horticultural Notes.

—Progressive Farmer, October, 1911.

The Premature Ripening of Navel Oranges.

—Southwestern Stockman, Nov. 24, 1911.

Horticultural Notes.

—Southwestern Stockman, Nov. 24, 1911.

Isolation as an Asset to the Arizona Farmer.

—Arizona Republican, Nov. 28, 1911.

Report of the Entomologist of the Ariz. Exper. Sta.

—Twenty-second Ann. Rept. Agri. Exper. Sta. pp. 550-556, Dec. 30, 1911.

The Alfalfa Weevil.

—Arizona Gazette, Dec. 30, 1911.

The Arizona Horticultural Law and its Applications Concerning the Importation of Plants.

—Circular 16, Ariz. Hort. Comm., Dec. 30, 1911.

Mistaken Ideas Concerning the Effects of Climate Upon Insects.

—Progressive Farmer, Jan., Feb., March, 1912.

Watermelon Wilt.

—Southwestern Stockman, March 22, 1912.

Horticultural Inspection Notes.

—Progressive Farmer, April, 1912.

The Eastern Peach Tree Borer.

—Southwestern Stockman, March 1, 1912.

The National Quarantine Bill.

—Southwestern Stockman, March 15, 1912.

Directions for Fighting the Codling Moth in Arizona.

—Solomonville Bulletin, Safford Guardian and Southwestern Stockman.

Reprinted in separate form March 30, 1912.

The Citrus Thrips and Other Species Affecting Citrus Trees.

—Monthly Bulletin, Cal. Comm. of Hort., Apr., 1912, pp. 162-171.

Reprinted in Southwestern Stockman.

Horticultural Notes.

—Progressive Farmer, May, 1912.

Several of the articles published in the Progressive Farmer and the Southwestern Stockman have been distributed to those most interested through an agreement with the publishers whereby the papers were sent out to special lists at the Entomologist's request.

The Entomologist has given only two public addresses during the past year. Owing to the necessity of being in touch with the inspectors throughout the shipping season it has been impossible to participate in Farmers' Institutes conducted in connection with the Arizona Agricultural Experiment Station. The following is a record of the two addresses referred to:

Codling Moth and Other Fruit Pests.

—Academy Building, Thatcher, Jan. 5, 1912.

The House Fly.

—McKinley School, Phoenix, Jan. 18, 1912.

TERRITORIAL AND COUNTY FAIR EXHIBITS

An exhibit was prepared for the Territorial Fair of 1911 and a smaller one for the Pima County Fair at Tucson. The special feature of the former exhibit was a display of many of the most notable insect pests existing in the United States but not yet established in Arizona. These included the following: The citrus white fly (*Aleyrodes citri*), the notorious citrus pest of Florida; the gypsy moth (*Porthetria dispar*) and the brown tail moth (*Euproctis chrysorrhoea*), two most destructive tree pests still confined to the northeast; the cotton boll weevil (*Anthonomus grandis*) the most destructive cotton pest; and the alfalfa weevil (*Phytonomus posticus*), the most destructive alfalfa pest. A portion of the exhibit is shown in Fig. 7.

PART II

INSECTS OF THE YEAR

DECIDUOUS FRUIT INSECTS

During the summer and fall of 1911 the Entomologist visited several sections of Arizona not previously visited, including points in Yavapai, Navajo, Greenlee and Cochise counties. The main object in view was to secure information in regard to deciduous fruit pests.

Although the majority of apple and pear orchards in the State are infested by the codling moth there are still many which are free from this pest. Every year new orchards have been infested through the unrestricted transportation and sale of infested fruit, and ignorance of the danger on the part of orchard owners and employees.

The wide range in climatic conditions found within deciduous fruit growing districts in Arizona has made it desirable to obtain banding and other codling moth records near Prescott, at an elevation of 5300 feet, to supplement those being made at Thatcher, at an elevation of 2800 feet. These records are being made this season for the first time.

The apple woolly aphid is more generally distributed among the orchards of the State than is the codling moth. In Graham county this aphid reaches the greatest destructiveness of which it is capable. In most other sections of Arizona the insect is comparatively insignificant. In several places the aerial form is as abundant as commonly observed in Graham county, but the root infesting form does

not thrive as well. The root infesting form is capable of greater damage and is far more difficult to control than the aerial form. The



Fig. 7.—Portion of exhibition at Territorial Fair, 1911.

character of the soil and cultural practices appear to determine the degree of destructiveness attained by the root infesting form of the insect. A new series of experiments has been undertaken during

the past year at Thatcher as a project of the Agricultural Experiment Station.

The grain thrips (*Euthrips tritici*), which received considerable attention in the last report, caused comparatively little damage to fruit trees in the spring of 1912.

The eastern peach borer (*Sanninoidea exitiosa*)¹ has been discovered in two places in Arizona during the last fiscal year. In July, 1911, it was found to be established and doing considerable damage to peach and plum trees in the city of Prescott and in a few orchards in the vicinity. A month later it was discovered in an old abandoned peach orchard located about forty miles north of Clifton on the Blue River. This orchard is about ten miles from any other and within a radius of twenty-five miles there are less than a half dozen other orchards. The peach borer has not been found so far in or near any of the important fruit growing sections of the State. The principal significance of the discoveries therefore is in their educational value. Certain nurserymen have been able, heretofore, to secure sympathy from their Arizona customers in their contention that if the peach tree borer had not been found in the State it was sufficient proof of the inability of the insect to exist here. The reality of the danger and the necessity for the inspection practices adopted in relation to this pest², are now clearly demonstrated.

The common eastern bag worm (*Thyridopteryx ephemeraeformis*) was discovered in August, 1911, in an orchard at Thatcher, Arizona. The insect was not previously known to exist in this section of the United States and it is possible that it is a recent introduction. The destructive capability of the insect was shown by three young apple trees, about six feet in height, which were completely defoliated, while more or less injury to several other trees was noted.

Numerous reports of damage to fruit trees by leaf cutting bees in the southeastern part of Arizona have been received. In several instances small trees were stated to have been almost completely defoliated. Specimens of the mutilated leaves have been sent with these reports, but only one specimen of the bee has been sent in. This was so badly crushed as to be unrecognizable. The work of the leaf cutting bee is generally recognized by the almost circular sections cut from the margins of the leaves. These sections, which are

¹ The adults were not bred out and the identification as *S. exitiosa* rather than *S. pacifica*, the California peach tree borer, is not complete. The circumstantial evidence, however, in regard to the source of the infestation is so strong that the writer does not hesitate to identify the specimens as of the former species.

² Circular 16, Ariz. Hort. Com., p. 23.

usually about the size of a dime, are taken by the bees to their nests and used as a nest lining. As the leaves are not eaten, poisoning the foliage affords no protection. Small trees or other plants subject to attack may best be protected by the use of mosquito netting. In the Salt River Valley complaints so far received indicate that leaf cutting bees confine their attacks to rose bushes.

CITRUS FRUIT INSECTS

A summary of the citrus thrips (*Euthrips citri*) investigations of 1911 has been published in the Twenty-second Annual Report of the Experiment Station.¹ The proportion of thrips scarred fruit in 1911 was about normal. The injury to navel oranges ranged from none at all to about sixty percent, scarred sufficiently to affect the market value. The average of scarred fruit was about twenty-five per cent, but the effect on the market value of the crop was much more than this would indicate. The scarring being confined almost exclusively to the fruit on the outside of the trees, and this fruit ripening earlier than the fruit in the interiors, resulted in the scarred fruit averaging about fifty percent at the packing house through which the bulk of the Salt River Valley oranges passed. Shipping was stopped by the frosting of the fruit on the trees while a large part of the unscarred interior fruit was still imperfectly colored. The citrus fruit growers consequently failed to secure the full benefit of the partial immunity of the interior fruit to thrips' attack.

The fire ant (*Solenopsis geminata*), a small black stinging species, did much damage in the Salt River Valley during the summer and fall of 1911. The principal damage was confined to a navel orange orchard planted the previous spring. The same ant was also noted in a citrus nursery. In the orchard the injury consisted in the establishment of a colony of the ants at the base of the tree followed by attacks upon the new shoots and upon the bark near the surface of the ground. The trees were budded upon sweet orange stock. Although the ant is of general occurrence in the Salt River Valley and has frequently been observed to destroy new growth of citrus trees, no injury to the bark of the ordinary sour orange stock has ever been noted. The new shoots are gnawed by the ants at their bases and may be completely severed or may shrivel and die while remaining attached. In the nursery, where the trees were budded on sour stock, only this injury to young shoots was observed. Many experiments in exterminating colonies of the ants located at the

¹ Report of the Entomologist, pp. 551-556.

bases of trees was undertaken, but no final conclusions were reached. Tentatively, it was decided that clean cultivation induced the establishment of nests at the bases of the trees where the best conditions of soil moisture existed; that the readiness with which the sweet orange stock provides gum exudations from wounds in the bark is an unfavorable characteristic; that the trees may be protected with Tree Tanglefoot, Tree Sticky, or some similar preparation; and that clean cultivated fields overrun with the pests may be partially cleared by providing attractive nesting material to centralize the myriads of small colonies.

During the past year a species of cicada known scientifically as *Cicada cinctifera* has proven capable of inflicting severe injury to young citrus trees. The insect is not known to the oldest and most observant citrus growers and in 1911 seems to have confined its attack upon citrus trees to a single locality in the Salt River Valley. What was probably this same species was reported from Buckeye as very destructive to young deciduous fruit trees. In this latter case its occurrence was said to have been noted annually for several years. The injury caused by the insect was similar to that inflicted upon trees by the periodical or seventeen-year cicada in eastern states. The adult female in depositing her eggs makes deep scars in the twigs and branches, which are then easily broken off by the wind.

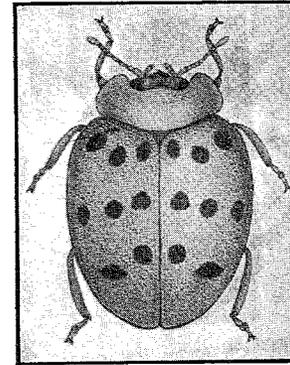


Fig 8—Corrupted lady bug,
an enemy of beans (Original)
Drawing by O. Heidemann

VEGETABLE CROP PESTS

The bean beetle or "corrupted lady bug" (*Epilachna corrupta*) is a pest which is found in many parts of Arizona and which does considerable damage to the bean crop each year. In one instance in Greenlee county it was necessary to replant several acres of beans on account of injury by this insect. One grower in Yavapai county severely burned the plants by using Paris green as a poison for the beetles. For these insects arsenate of lead or arsenite of zinc is recommended. The former in paste form should be used at the rate of one pound of poison in 10 gallons of water, while in powder form it should be used at the rate of one pound in 15 to 20 gallons of water.

Arsenite of zinc (powder) should be used at the rate of one pound to 20 to 24 gallons of water. The poison should be applied as a fine spray to the under surfaces of the leaves.

The military grasshopper (*Taeniopoda picticornis*) accompanies the "corrupted lady bug" as a bean pest in Cochise county. Prof. G. E. P. Smith, Irrigation Engineer of the Experiment Station, wrote on September 20 that this grasshopper and the lady bug were damaging beans in the Sulphur Springs Valley. The daily papers on October 15, 1911, printed a dispatch from Tombstone, Arizona, to the effect that the grasshopper had destroyed nine acres of beans, appearing in large numbers when the plants were eight inches high. Arsenite of zinc or arsenate of lead are recommended for the grasshoppers although no tests have been made with these poisons against this insect as far as known.

FIELD CROP PESTS

Two unusual pests of field crops have been noted since the preparation of the last report. Under date of Sept. 11, 1911, Mr. J. T. Hilliard, of Aquila, Maricopa county, wrote that insects of which he enclosed specimens were eating his alfalfa. The insects proved to be blister beetles, but were so badly crushed as to be unrecognizable.

The complete loss of thirteen acres of milo maize in the Salt River Valley was reported by Mr. Pickrell of Phoenix on September 27, 1911. Stink bugs had been observed in large numbers in the field feeding on the seeds, but no serious injury was anticipated at the time. Upon the ripening of the crop it was found that a large proportion of the seed heads had been destroyed. A crop of two tons to the acre had been expected, but late in September an examination showed that there was hardly enough good seed to pay for harvesting. By weighing normal and damaged heads of seed it was found that the latter were about one-half of the normal weight. When the injury was first reported the bugs had almost entirely disappeared, but a specimen of a well known pentatomid bug known as the grain bug (*Pentatoma sayi*) and a specimen of a pentatomid of the genus *Euschistus* were found. From the past history of the insect it is probable that the grain bug was responsible for the damage to the crop of milo maize. Examinations of this crop in other sections of the Salt River Valley in September and October showed that the attack was strictly local, no bugs or injured seed heads being found.

INSECT MENACES

Many apple growers in Arizona suppose that the codling moth and the apple woolly aphis constitute the complete list of insect pests of the apple. Likewise, some citrus growers who are not familiar with the citrus pests of California or Florida suppose that there is only one kind of a scale insect which attacks citrus trees or that all scale insects have the same habits and are similarly effected by climatic conditions. Fruit growers would indeed be fortunate if these suppositions were correct.

It is not claimed for the plant inspection service and for the quarantine restrictions maintained under the State law that all danger of further introduction of insect pests is eliminated. Inspections and quarantines are admittedly imperfect. Notwithstanding the prohibitive quarantine regulations maintained by both Arizona and California to prevent the introduction of the citrus white fly this pest is still a notable menace to the citrus industry of the Southwest. While the quarantines probably eliminate nine-tenths of the immediate danger, continuous and efficient inspection service is necessary to enforce the provisions of the quarantines and to reduce to a minimum the dangers which can not be directly affected by legal restrictions upon shipments of plants.

To a greater or less degree all pests which do not exist in Arizona and which are enemies of plants or crops having a commercial status in the State may be said to be menaces. In this report four of the leading menaces are briefly discussed for the information of the public. The ones here discussed are considered of the most timely interest, and they alone are sufficiently threatening to demand that no effort be spared to give the State of Arizona the fullest possible measure of protection.

FRUIT FLIES

The fruit fly menace is one of the greatest importance to all sections of the country. The interest of the public as consumers of fruits and vegetables is so great that a national quarantine measure providing all possible protection is of the most urgent necessity. It is greatly feared by entomologists, fruit growers, and others who are informed concerning the matter, that the continued neglect of our national congress to enact a suitable quarantine law will soon result in irreparable damage.

Three species of flies constitute the "fruit fly" menace of the United States: the Morelos orange worm (*Anastrepha ludens*) of Mexico, the melon fly (*Dacus cucurbitae*) of the Hawaiian Islands, and the Mediterranean fruit fly (*Ceratitis capitata*) of Australia, South Africa, Hawaiian Islands, etc. Infestation renders the fruit or vegetables attacked disgustingly worthless. The mere record of '79 maggots found in a single ripe tomato from Hawaii by a California port quarantine officer is sufficient to classify such pests in the first rank of undesirability.

The orange worm attacks citrus fruits, mangoes and guavas; the melon fly attacks melons, cucumbers, squashes, tomatoes and mangoes; and the Mediterranean fruit fly attacks many fruits and

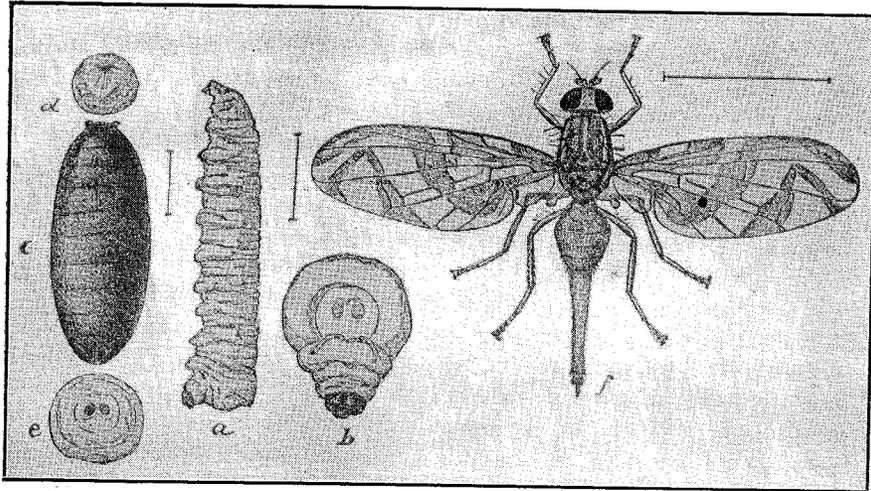


Fig. 9.—The Mexican orange maggot (*Anastrepha ludens*): a, larva enlarged; b, anal segment of same, from behind, still more enlarged; c, puparium, enlarged; d, e, head and anal segments of same, still more enlarged; f, adult female, enlarged. Straight lines indicate natural size of larva or maggot, puparium and adult. (After Riley in *Insect Life*.)

vegetables including citrus fruits, stone fruits, pears, beans and peppers. The experience of the port inspectors of the California Commission of Horticulture at Los Angeles, San Francisco and San Diego has shown that ship passengers frequently bring to California in trunks and hand baggage fruits from Hawaii and foreign countries. Train passengers from California carry oranges from that state through Arizona and Texas and it is equally certain that passengers from Mexico bring into Texas and Arizona fruits grown in districts in Mexico where the orange maggot exists.

The state of Texas maintains an inspection service at Laredo and El Paso, but up to this time Nogales has been an unprotected

entrance point. It is plainly the duty of Arizona to place an inspector at Nogales, not only for the protection of our own citrus industry, but in reciprocation for the similar benefits we receive from the inspection service of Texas and California. The latter state is fortunate in not having direct railroad connection with southern Mexico, but the inspectors at the Pacific coast ports in defending their own state against the threatened introduction of the three fruit maggots here discussed are doing work of incalculable advantage to Arizona and to every other state.

WHITE FLIES

There are two species of citrus infesting white flies which are especially to be feared by citrus growers of the Southwest. One of

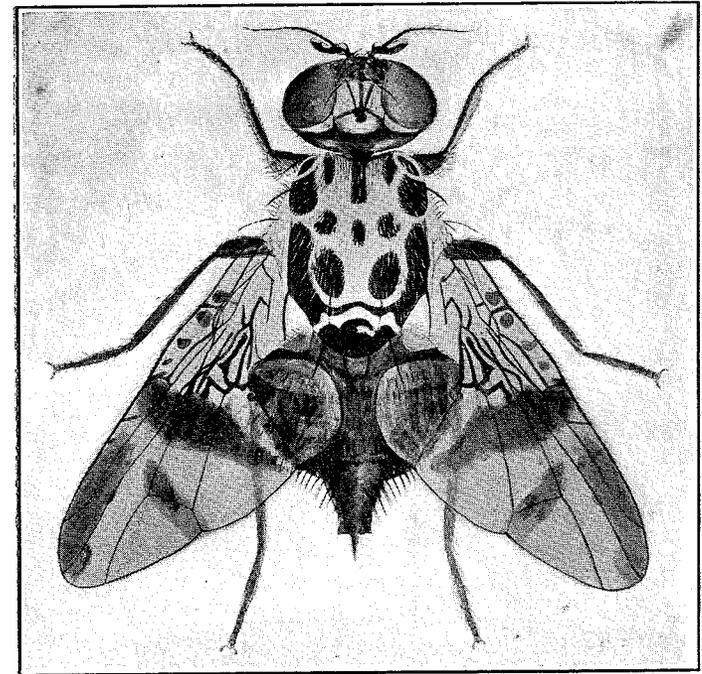


Fig. 10.—Mediterranean fruit fly (*Ceratitis capitata*) adult female, greatly enlarged (After Birdnekoﬀ. Cut loaned by Cal. Com. of Hort.)

these is the citrus white fly (*Aleyrodes citri*) and the other is the cloudy winged white fly (*Aleyrodes nubifera*). The first is the one commonly known as the Florida white fly and especially favors oranges and tangerines, rather than grape fruit. It has many food plants, but

one most important ones aside from citrus concerned in the spread of the insect are cape jessamine and privets. The second species named favors the grape fruit, although it attacks all other kinds of citrus fruits. Aside from citrus the only known food plant of the cloudy winged species is the rubber plant (*Ficus nitida*).

White flies are not true flies, but are closely related to scale insects and attack only the leaves and never the bark or fruit. Both of the species of white flies mentioned above have demonstrated their ability to become established and thrive in hot, dry citrus regions. The citrus white fly was discovered in 1906 established at Marysville and Oroville in Yuba and Butte counties, California, and the same year the cloudy winged white fly was discovered at Bakersfield in Kern county. Fortunately, these infested points are well isolated from the more important citrus growing sections, and by conducting an energetic warfare against the pests they appear to have been completely exterminated at Oroville and Bakersfield. The infestation at Marysville was also believed to have been thoroughly

wiped out, but recently the insects have been found again at this point in small numbers by agents of the State Commission of Horticulture.

The introduction and establishment of both species of white flies in California at the localities named has amply demonstrated that climatic conditions cannot be relied upon to prevent injury from these insects in any citrus fruit growing region where they may be introduced. At Marysville, California, the temperature maxima are higher and the humidity lower than at Yuma or Phoenix, Arizona, during the period of the year when the citrus white fly is most susceptible to climatic influences. From April 1 to November 1 the average rainfall at Marysville is 4.1 inches, and at Phoenix 4.0 inches. The cloudy

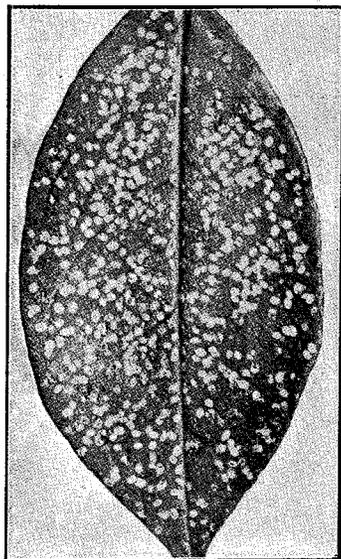


Fig 11.—The citrus white fly, dead larvae, and pupae and pupa cases from which adults have emerged. Live larvae and pupae are nearly transparent and difficult to detect on the leaves. (From Morrill and Back, U. S. Bureau of Entomology).

winged white fly has also become established and has thrived in a

place where climatic conditions appear to be fully as unfavorable as in citrus growing sections of Arizona. At Bakersfield, California, the maximum temperatures are nearly as high as at Phoenix and Yuma, while the humidity is not materially different. The average annual rainfall at Bakersfield is only 4.1 inches as compared with 7.8 inches at Phoenix. The foregoing comparison of climatic conditions is made to show the absurdity of the unsupported contention sometimes heard to the effect that the "white fly" could not live in Arizona.

The citrus white fly is of wide occurrence throughout the southeastern states on citrus, Cape jessamine, privets, China trees and other food plants. It exists at present in every important citrus growing county in Florida and the danger of the insect being distributed on nursery stock is now immensely greater than it was even ten years ago. Furthermore, owing to the white flies being winged in both sexes of the adult stage these insects are much more easily established in a new locality than are scale insects which have to rely upon a chance meeting with suitable food plants. Even when the trees are defoliated, a single leaf overlooked and accidentally included in the packing material might be the means of carrying white fly pupae producing one hundred or more adult insects. Reliance upon the uncertainties of inspection under the circumstances is unjustifiable and quarantines are therefore necessary. Even these measures need the support of faithful and ever watchful inspectors, as certain events of the past year in Arizona and California clearly show. Three lots of the quarantined food plants of the citrus white fly have reached Arizona during the past year, including a shipment containing citrus trees from an infested section in Florida and a postal package of Cape jessamine blooms and foliage from an infested locality in Texas. The postal package was received in Phoenix and learned of through a newspaper item, there being no requirements in regard to state horticultural quarantines applicable to the U. S. postal



Fig 12.—Adult white flies. The cloudy winged species, slightly enlarged. (From Morrill and Back, U. S. Bureau of Entomology).

service.¹ The two other lots, one by express and one by freight, were refused release by the inspectors. In California two shipments containing Cape jessamine infested by the citrus white fly were held up and destroyed by the inspectors. One of these shipments was from North Carolina and the other from Mississippi.

Food plants of the citrus white fly are grown in conservatories and greenhouses in all parts of the country. While a general quarantine against all white fly food plants shipped from all states is not justifiable, extra watchfulness in this direction is required of all Arizona inspectors. Fortunately the cloudy winged white fly appears to be limited to the rubber plant, aside from citrus, and the danger of its introduction is correspondingly less.

THE RED AND YELLOW CITRUS SCALES

Of the many species of scale insects which are listed as enemies of citrus fruits, the California red scale (*Chrysomphalus aurantii*) and the yellow scale (*Chrysomphalus aurantii* var. *citrinus*) are the most to be feared by Arizona citrus growers. In two² of the three leading citrus fruit producing counties in California the red scale ranks first and the yellow scale second as citrus pests. The red scale is a very destructive pest in orange groves in Sonora, Mexico, as stated by Dr. J. E. Coit³ and as indicated by the condition of Sonora oranges which have been shipped to Arizona during the past year. The yellow scale is found in the Sacramento and San Joaquin valleys in California, although in the latter district the pest has not as yet become established in commercial citrus orchards. The recent discovery of the red scale in a thriving condition on a rose bush in Phoenix, Arizona, has been noted in this report under the subject of orchard inspection. Considered together, the red and yellow scales are definitely known to thrive under the entire range of climatic conditions found in citrus fruit growing sections of California and Arizona.

The scales here discussed are found on several food plants other than citrus and the danger of their introduction into the citrus growing sections of Arizona through plants sent in by mail or through the failure of inspection to disclose their presence, coupled with their

¹ Section 8, order number 6158 issued by the Postmaster General under date of March 23 1912, provides that:

"Nursery stock, including field grown florists stock, trees, shrubs, plants, vines, cuttings, grafts, scions and buds (which may carry injurious insects) may be admitted to the mails only when accompanied by a certificate from a State or Government inspector to the effect that said nursery stock has been inspected and found free from injurious insects."

² San Bernardino and Riverside.

³ Bull. 58, Ariz. Agr. Exp. Sta., pp. 317-318.

known ability to thrive under our climatic conditions, makes the red and yellow scale menace one of uncommon prominence and of the most immediate interest to citrus fruit growers. The comparatively slow spread of the pest during the first years of its establishment in a new locality will, however, greatly favor the continued success of the protective measures established by the State of Arizona.

THE ALFALFA WEEVIL

This pest has been under investigation by agents of the Bureau of Entomology, U. S. Department of Agriculture, in continuance of the work begun by the Utah Experiment Station, noted in the previous report. A preliminary report of these investigations of the Bureau of Entomology has recently been published.¹ It has been found in Utah that there is a partial second generation of the alfalfa weevil. This suggests the possibility of a full second generation in the warmer alfalfa growing sections of Arizona. This would mean proportionately more damage, or increased expense of control,—probably both of these disadvantages.

The best methods of control so far discovered consist in crushing the insects in the field after the first crop of the season is cut. For this purpose a wire brush machine has been found to be the best means. This treatment is not applicable to the first crop, which may be greatly reduced in quality with comparatively slight reduction in quantity. In the bulletin of the Bureau of Entomology here referred to, the following observations are noted:

"While studying the alfalfa weevil on various farms in Salt Lake Valley during the month of April, 1911, it was found that many farmers, through a shortage of forage, were feeding the weevil-injured hay of the first crop to their horses. This hay contained so many old cocoons, and was so dusty from larval excrement and dead bodies of weevil larvae, as to render it unfit as feed for horses. On several occasions horses were observed coughing from the effects of this dust. In fact, many farmers consider the first crop from severely infested fields as almost valueless as horsefeed."

Several parasites of the alfalfa weevil have been introduced from Europe by the Bureau of Entomology and it is hoped have been successfully established in Utah. It will be several years in all probability before the effectiveness of these parasites will be fully demonstrated. Even with the greatest degree of effectiveness that can reasonably be hoped for, there will probably be fluctuating relationships between the pest and its parasites which will result in periodical losses to the alfalfa crop. Such relationships are common

1. Bull. 112, Bur. Ent., U. S. Dept. Agr.

to nearly all insect pests which are said to be successfully controlled by parasites or other natural enemies.

As reported in Bulletin 112 of the Bureau of Entomology the weevil has now spread into the southwestern part of Wyoming and the southeastern part of Idaho. There are no authentic reports of this insect's occurrence in states other than Utah, Wyoming and Idaho at this writing.

The foregoing review of recent alfalfa weevil work and discoveries indicates a more hopeful outlook than at one time existed as far as Utah and the more northern alfalfa growing districts are concerned.

Arizona is greatly interested in the successful control of the pest where it now occurs since this will retard the rapidity of its spread. Confronted with the possibility of an increased annual rate of weevil multiplication alluded to in a previous paragraph, with the possibility of an annual expense of from two to five or more dollars per acre for mechanical means of control, with the probability of a great depreciation in the value of even slightly injured hay, and with the probability of state quarantines shutting out Arizona hay from its outside markets if the pest were to become established in this State, the alfalfa growers of the Lower Colorado, Salt River and Gila valleys cannot afford to be unprotected against the introduction of this insect. That the interests of the State as a whole in the matter of alfalfa weevil protection are now generally recognized by all who have given the matter any consideration, is evidenced, by the action of the State Legislature providing both the legal means and the appropriation requested for this work.

WORK UNDER THE AMENDED CROP PEST LAW OUTLINED

The text of the law amending the Horticultural Law of 1909, which for convenience may be designated The Crop Pest Law of 1912, is printed elsewhere in this report. As a matter of public interest it seems desirable to present, in concluding this report, a brief discussion of the various lines of work now adequately endowed for the first time.

Under the new law the first consideration, as in the past, should be the *exclusion of pests* not yet existing or not yet of common occurrence in the State. In the case of some pests absolute quarantines against infested districts are recognized as the only practicable method of providing the required protection. In other cases im-

portations may be permitted under safe regulations. The law provides full authority for maintaining such quarantines and regulations and carries an appropriation which will permit the inspection of all importations of plants and such other articles as are likely to be infested with or to harbor pests of any kind.

Second in importance to the work of excluding pests by every practicable means is that of *field, orchard and garden inspections* so that pests introduced, notwithstanding the best possible efforts to exclude them, may be discovered early and suppressed or exterminated before becoming too firmly established. Inspections for the alfalfa weevil in all alfalfa growing sections of the State, for citrus pests in Districts 2 and 3, and for deciduous fruit pests in Districts 1, 2, 3 and 4, constitute the leading features of this work.

Control work follows that of general inspections in importance and applies to pests already established, or any which may hereafter become introduced and established, in spite of all practicable preventive measures and efforts.

Educational work, the fourth important division, is an important adjunct to the three considered above. In the past this has been conducted by means of publications, public addresses and exhibits at fairs. A portion of the correspondence of the Entomologist might also be considered educational work. Educational work will naturally demand more attention in the future. It is of especially great importance in connection with the alfalfa weevil, greatly strengthening the protection against this insect at comparatively slight expense.

There are numerous destructive insects in Arizona which have never been investigated and for which no satisfactory remedies are known. *Investigations* are necessary to determine the most effective methods of control in such cases, as well as in those where the local conditions render the usual remedies wholly or entirely ineffective. In addition to such insect investigations as may be conducted by the writer as projects for the Agricultural Experiment Station, the demand for information concerning insect pests necessitates spending considerable time and effort in this line in direct connection with the administration of the law and in otherwise fulfilling its purpose to protect the agricultural and horticultural interests of the State.

A. W. MORRILL,
Entomologist.